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Modelling Service Life and Life-Cycle Cost of Steel-Reinforced Concrete

Report from the NIST/ACI/ASTM Workshop held in Gaithersburg, MD on November 9-10, 1998

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William M. Daley, *Secretary*
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Gary R. Bachula, *Acting Under Secretary for Technology*
National Institute of Standards and Technology
Ray Kammer, *Director*

A TRIBUTE TO JAMES CLIFTON (1933 - 1999)

James Roger ("Jim") Clifton died unexpectedly on January 19 after an illustrious career devoted to advancing knowledge of the materials science and durability of inorganic construction materials. He was an important contributor to the workshop that is the subject of this report – a subject to which he had made many important contributions over the last thirty years. For example, he led the early research on epoxy-coated reinforcing bars which became the foundation for a new industry and for which he and Robert Mathey received the Lindau Award from the American Concrete Institute in 1986. As chairman of ACI Committee 222 on Corrosion of Metals in Concrete from 1985 to 1989, he led the drafting of the Committee's state-of-the-art report published in 1989 and later, as chairman of ACI Committee 365 on Service Life Prediction from 1993 until his death, he led the drafting of that Committee's state-of-the-art report. Jim also contributed at least as greatly to the field through his leadership of the Inorganic Building Materials Group in NIST's Building and Fire Research Laboratory – a Group that has led in the application of computational materials science to concrete and related cement-based materials, an example of which is provided by the 1996 paper, Service Life Prediction of Chloride-Exposed Steel-Reinforced Concrete, of which he was a co-author.

Jim spent about the last thirty years of his professional career (1970 – 1999) at the National Institute of Standards and Technology (formerly the National Bureau of Standards), first as a Research Physical Scientist and then, from 1981 on, as Leader of the Inorganic Building Materials Research Group. In 1978, he began the computational cement research which led to the developments for which the team he built, and in which he took great pride, is now world-famous.

Jim was a good friend and colleague. He was generally open-minded, sometimes impatient, and quick to express an opinion if he thought someone was wrong. We had occasional disagreements which we were always able to resolve amicably – and we had many laughs together. Jim liked to write and he wrote fluently and well. However, his handwriting was often illegible, so he and his colleagues welcomed the advent of word processors. Jim bought enthusiastically into the electronic age in other ways, too, as in his pioneering work with Larry Kaetzel in the development of knowledge-based expert systems and CIKS (computer-integrated knowledge systems) for concrete. A measure of the significance of the work is that the expert system, HWYCON (a decision-support system for HighWaY CONcrete), issued in 3000 copies by the Transportation Research Board in 1993, and it is now used in virtually all of the Nation's state departments of transportation.

Jim was a good leader who was encouraging to his staff in their work, and seriously concerned about their welfare and professional growth. He looked for excellent performance, but was understanding and helpful when unforeseen problems arose. He recognized the importance of secretaries and was grateful for the good secretaries he had.

Jim was highly-motivated, and worked hard and productively. He was much appreciated by sponsors of his research because he could be relied on to fulfill his obligations faithfully and on time. He earned the trust of sponsors and often became friends with them.

Though Jim worked hard, he always went home promptly at the official end of the workday. He was a private person, but he obviously enjoyed being at home with his wife, Eva, to whom he had been married for 31 years, and he was proud of his son, Michael.

In his first years at NIST, Jim was one of the softball gang -- I did not see him play, but I heard he played with the enthusiasm he showed in most things he chose to do. He had a hobby of building and flying model airplanes and I remember an occasion on which he was very upset when he lost one that crashed in a cornfield and could not be found.

Jim liked to travel to new places and, as an authority on the preservation of historic stone and adobe structures, his work gave him opportunities to do so. As examples, he visited archeological sites in Arizona and New Mexico as a consultant to the National Park Service, and he was a member of a UNESCO team that visited the site of the ancient city of Mohenjo-Daro in Pakistan to advise on its preservation. Because of his knowledge of stone preservation, he was consulted on the treatment of the stone used in the restoration of the West Front of the U.S. Capitol.

Through his chairmanship of several technical committees or subcommittees in ACI, ASTM, and RILEM, Jim found opportunities to collaborate with persons from other organizations, not only in drafting committee documents, but also in co-authorship of other publications. He had an outstanding publication record with at least 140 publications to his credit. Among awards received for his writings and his research were the Silver medal of the U.S. Department of Commerce in 1975, the Communicator Award of the NIST Building and Fire Research Laboratory in 1976, the P.H. Bates Award (which I was proud to share with him) from the ASTM Committee on Cement in 1978, and the Lindau Award from ACI in 1993. Jim was elected to the Fellowship of the American Concrete Institute in 1993.

Over the years, Jim and I wrote several papers together, and we planned to co-author the present report. Unfortunately, it was not to be. However, I felt it fitting to include this tribute to him -- as a fine person, a good friend, a dedicated and highly motivated civil servant and scientist, and a major contributor to the field that this report is intended to help advance. It is noteworthy that Jim left his mark on one of the last actions of the workshop when, in rapid response to one of the workshop recommendations, he approved the setting up of a new subcommittee in the ACI Committee (ACI 365, Service life Prediction) that he chaired.

Jim is survived by his wife, Eva, his son, Michael, and his sister. I am grateful that we were able to share him with them.

Geoffrey Frohnsdorff